Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
The Emergency Alert System	)	EB Docket No. 04-296
	)	
Frank W. Bell	)	

Re: NOTICE OF PROPOSED RULEMAKING

EAS is now in an environment that was unforeseen when it was first developed. Broadcasting is mostly digital, although compatibility with analog radio must be maintained. The price of transistors has fallen so much that processing of the EAS protocol when received digitally in consumer electronics is becoming an insignificant added amount. However the economics of consumer electronics worldwide is so tilted against national or regional specifications that only worldwide standards have a prospect of becoming adopted by consumer electronics manufacturers. Many of these are in China, which does not have a dependable relationship with the U.S. like the E.U. does.

There are new needs. The possibility of broadcasting maps of flood risk areas was a desirability apparent for the public to prepare for the inundation of hurricane Sandy but was not implemented in time and caught large areas of population by surprise. Another is the passage of the Early Earthquake Warning System (SB 135 in California). Both of these capabilities would require processing in consumer electronics to work around the realities of broadcasting. This would require that the Consumer Electronics Association be a participating stakeholder. While their interest in a national mandate specification is probably low, they would likely participate in the development of standards that have the potential to become world standards. This is not new, the Common Alert Protocol (CAP) is currently in process to become an ITU and hence world standard. There is no fundamental reason why an improved EAS could not follow the same track. This is a question for the FCC to consider. EAS has been the FCCs' baby for many years, it would be a transition for EAS to become an adult player on the world emergency mitigation stage. However the FCC would remain a stakeholder and make the Rules. If an improved EAS could be accepted as an optional feature for consumer electronics and not a mandate is a fundamental question. As shown by my first submission in 2009, the technology is practicable.

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Philosophy and Strategy for Electronic Public Alerting.

Frank W. Bell

Philosophy

1) Technology is developing and consideration that are not expected to be applicable until up to 20 years in the future are still relevant.
2) People want relevant alerts. These have a positive value. People do not want irrelevant alerts. These can be considered as having a negative value. The value per person is not determined, but may be in the future. This would be of assistance in justifying budgets. Meanwhile comparisons between similar situations are the best data available.
3) Disasters are very varied and unpredictable. They do not appear to be the fringe of a normal distribution, but are referred to as Black Swans in the book by Nassim Nicholas Taleb. The best

mathematical description of disasters I have found was on a FEMA web page which showed a curve depicting an approximately inverse relationship between the frequency and severity of disasters. There were no numerical values on the scales. As this inverse relationship is that of the $1/f$ noise curve that electronic engineers are acquainted with, this is a reasonable first approximation until more data is available. The type of disaster varies with the frequency and severity on the curve. For example, meteorite impacts, earthquakes and tsunamis are at the infrequent but severe end. Local disasters and emergencies are at the frequent and not necessarily fatal end. So $\check{S}=\frac{K}{f}$ where the value of the constant *K* is not currently known.

4) The onset, or time between first detection of a potential problem and the beginning of the impact of it varies considerably. Events that may take a month or more onset time are within the scope of normal news coverage, reporting by normal channels and normal management processes. These normally do not require Electronic Public Alerting.
5) While the U.S. Federal Government is responsible for participating in or overseeing Emergency Management in the U.S. jurisdiction, the nature of disasters may be very similar elsewhere in the world. So in the interest of economic development of solutions, those which are applicable elsewhere in the world may be advantageous because of the economics of mass production.
6) Consumer electronics is a technological area that is increasingly a global economic activity. For example, the current divisions of the world by TV standards are expected to be overcome by future TVs as the FoBTV (Future of Broadcast TV) Conference has decided. This should be appreciated rather than the U.S. insisting on definitions that are incompatible with e.g. EU definitions.
7) Given 5) and 6), the development of engineering standards is preferable to the development of legal and mandated definitions. These engineering standards should be capable of being compatible with other international standards and also of being adapted as international standards by organizations such as ISO or ITU (www.iso.int, www.itu.int). The Common Alert Protocol (CAP) is now on this path, and other standards should accompany that.
8) The psychology of people in emergency situations is relevant. For example “The Unthinkable: Who Survives When Disaster Strikes – and Why” Amanda Ripley illustrates this. This has led to the 3-3-30 rule, which recommends making an alert with a maximum of 3 points in 3 sentences with no more than 30 words. This is based on mental noise theory and disaster stress experience.
9) The economics of Moore’s Law apply. An example is that this year, the number of transistors in the world is approximately 100 times the number of ants. So solutions using more transistors are likely to be more widely adopted in the future. This means that solutions can be applicable even to poor people. However as some architectures of consumer electronics are unable to support improved alerting features, this should be an optional feature for the public to be educated about.
10) Given 2) and the coverage areas of broadcasting, it is not possible to directly select an area as small as a cell sector (or tower if not in sectors). However it is desirable to able to select areas by polygon in order to increase the value of Electronic Public Alerting. The solutions would vary by distribution method, but this is not of concern to the Emergency Management. R Dale Gehman

has filed a submission to the FCC regarding the problem of the selective distribution of EAS messages. A copy is available at www.pattcom.com/eas.

11) The efficiency of the alerting may be defined as; {(reached targeted public)-R(reached non-targeted public)}/(targeted public). This is not a definition used in "The Efficiency of the Emergency Alert System" by Dr. Rita Kepner. However this definition is more in line with calculating the value where R=(value of annoyance by untargeted public)/(value of message to targeted public). This is assuming that there is 100% penetration of the technology to the public.
12) Different technologies can be further compared by comparing their actual penetration to the public and the acceptable maximum message rate. E.g. NOAA Weather Radio has a low penetration but can give new alerts almost continuously.
13) Another variable is the response time of the system. This is of particular importance to earthquake alerts for example. These are infrequent, so effectively this reduces the penetration for such severe but infrequent alerts, and makes this analyzable on a chart with one less variable.
14) Quality of engineering applies e.g. the reliability of the equipment, the QC (Quality Control) of the message delivery system, and the reliability of the system. For example, it should be possible for radio and TV messages to provide a redundant delivery technology to the CAP and EDXL network. The present Emergency Alert System (EAS) cannot do this.
15) Additional capabilities are appropriate to consider. E.g. the delivery of flood/inundation maps to the public, emergency booklets as file data broadcasts, earthquake alerting. The latter requires very rapid message delivery which may be selective, which the present EAS cannot deliver.
16) Future technologies should be as compatible as practical to existing technologies, particularly CAP and their predecessor (if applicable).
17) The needs of stakeholders should be provided for. E.g. First Responders would like a unified message generator that is simple to use and has the ability to be used as part of local exercises so as to make operators familiar with the use of it. Broadcasters would like as system that reduces expenses (e.g. engineer time required), improves the audience listening experience (e.g. not interrupting desired programming if possible) and improves the bottom line.

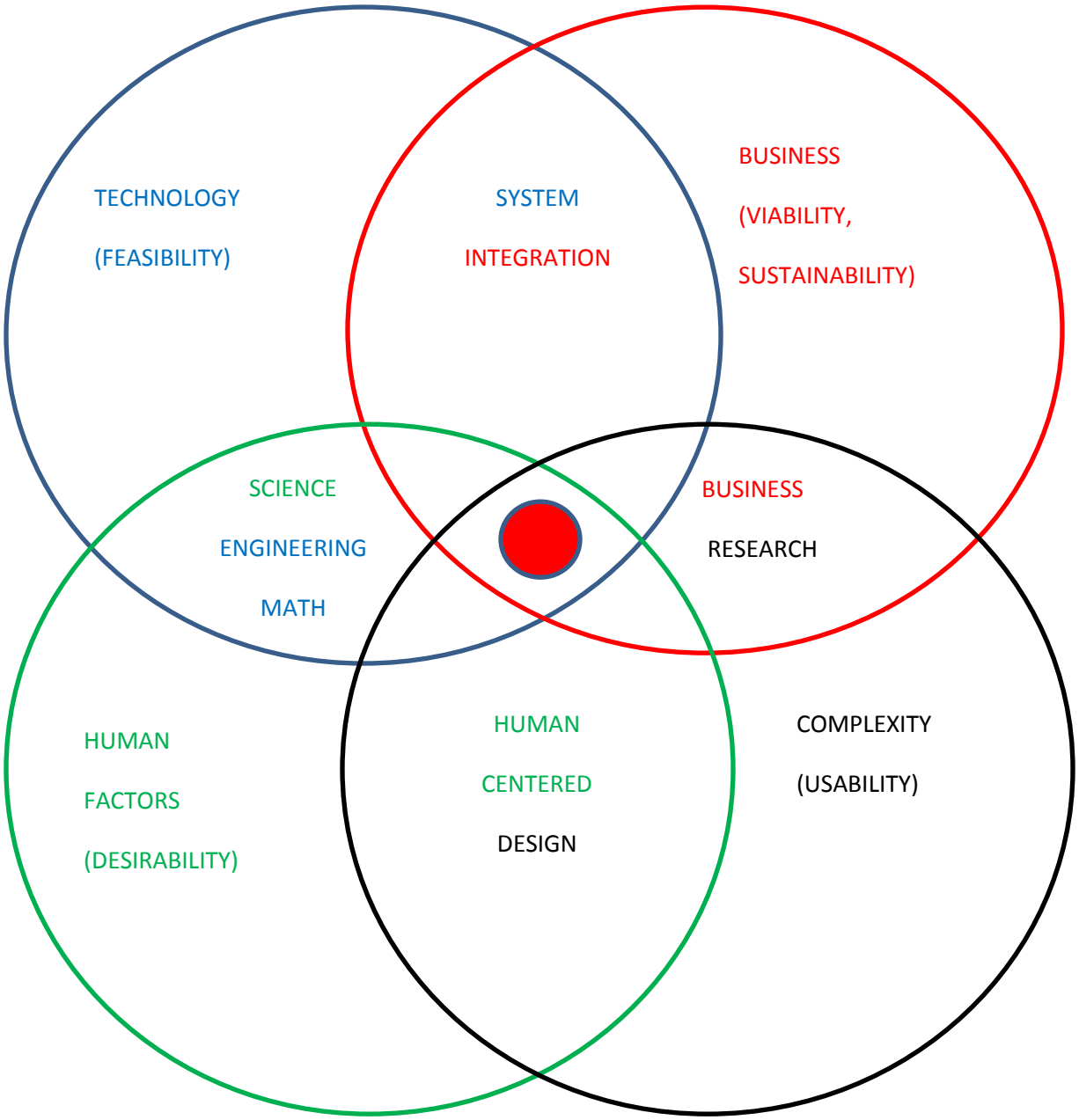


Figure 1

This shows the importance and place of activities such as market research when well done.

18) This is a complex, high technology project and understanding of Project Management in such situations is relevant. For example “Reinventing Project Management” Aason J. Shenhir and Dov Dvir, “Extreme Project Management” Doug DeCarlo, Edward De Bono books and courses on “Lateral Thinking” and intersections of planes of thinking, “Normal Accidents” Charles Perrow. The latter is in an article in EDN magazine (www.edn.com) “Managing Complexity and Reducing Risk” by Kevin C Craig June 2013. This article has a diagram similar to De Bono’s work and is reproduced below. The large circles can be considered as planes of thinking.
19) Normally people mill before acting, but this is not an option with earthquakes, so “Mill or Drill”.
20) The system should provide all the capabilities required by every situation, however the Emergency Manager software provides that user interface and ease of use, checking & safety measures and limitations appropriate would be the function of this software. Menus more than three deep have been found to be difficult for users.
21) The system should provide for adequate languages to be used. A maximum of six is proposed as Switzerland has 3 official languages plus English and two more for local languages. The consumer user interface is where the language selection is made.
22) Handicapped people have various requirements. The consumer user interface is where these are to be provided for, e.g. text to braille conversion.

List of Different Current Alerting Technologies

24) CAP and EDXL (various flavors). These may be direct to computers, but the delivery may be by Broadband EAS for example.
25) WEA (Wireless Emergency Alerts) to cellphones.
26) MEAS. This is an ATSC delivery of alerts to smartphones which have ATSC receivers
27) EAS on radio and TV.
28) ETN (formerly R-911) on POTS (Plain Old Telephone Service. Whether this covers FiOS and cable TV phones is not currently known.
29) Alerting service vendors. Larger organizations have specialized needs that such vendors provide.

EAS Strategy

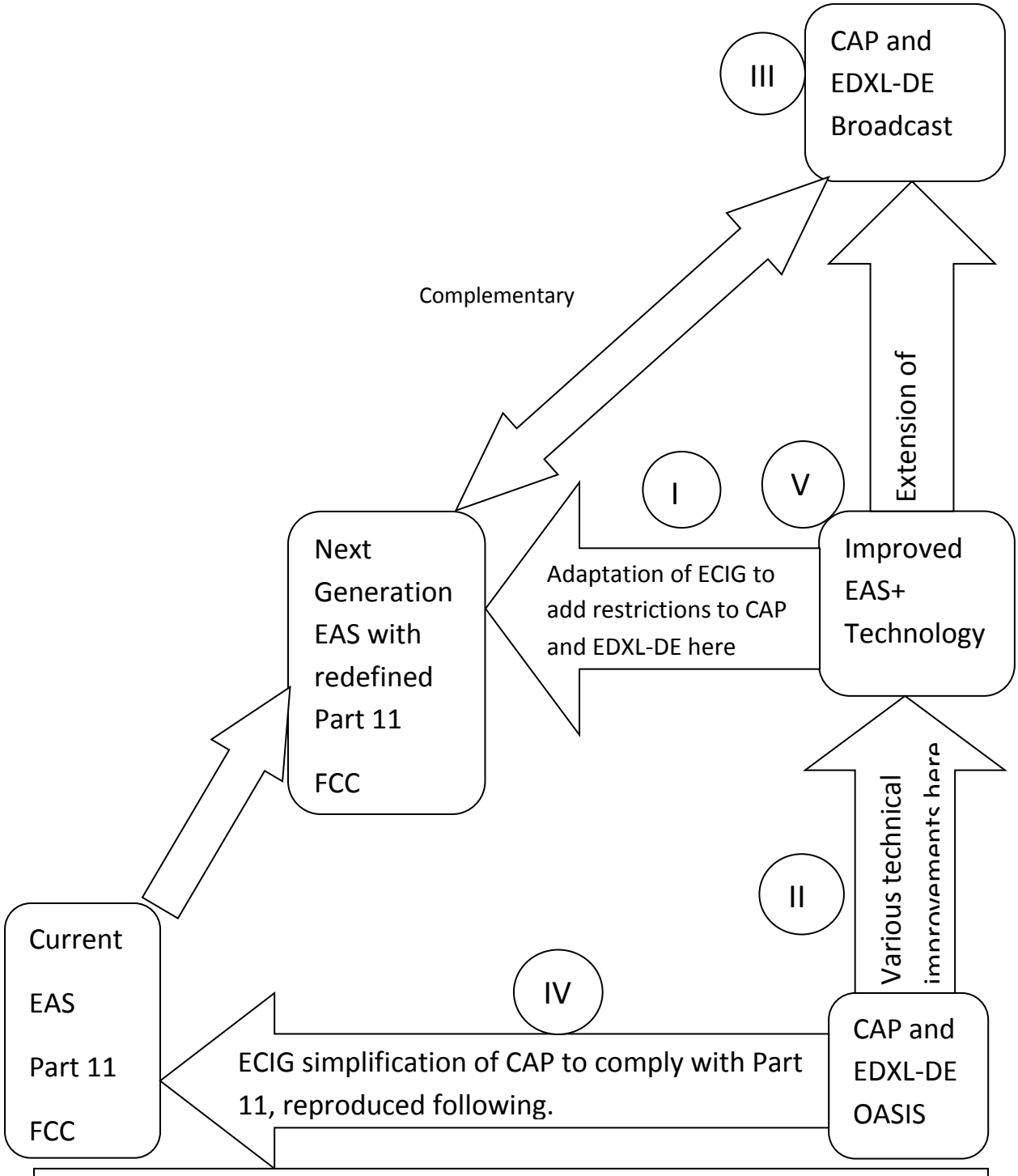
30) Equipment that is currently installed should be able to be used as much as practicable. This means that software upgrades are preferable.
31) Future development of broadcasting should be considered. E.g. more of HD Radio. More transistors in consumer electronics.
32) Involve the Consumer Electronics Association in standards development, and appreciate what they can offer as well as their limitations.
33) Analog radio would remain the existing EAS specification in the U.S., with perhaps a few modifications to Encoder/Decoder software. Analog TV, if used, could carry EAS on the IFB audio channel in addition to program. A high data rate modem can be used transmitting all the data with a maximum of 2 minutes.
34) With TV providing a higher data rate than HD Radio, the Digital Daisy Mesh could be more TV-centric than radio-centric as at present. The details are up to the State Plans. Digital TV receivers and HD Radio tuners with data outputs would be needed. This is an upgrade version of the current Daisy Chain. It would be possible for EAS messages to be delivered from the LP stations to distant stations without disturbing the LP stations local audience.
35) A demonstration system for TV and HD Radio needs to be built to debug software, performance and interoperability issues. This should address the most difficult problem of delivering earthquake alerts and consumer receiver compatibility with the feature. Compliance means that the equipment provides FEC (Forward Error Correction) and some other capabilities not required for consumer electronics.
36) The TV spectrum is under economic pressure from other potential users. Also a new and most efficient compression standard has been released MPEG-4+H.265. This is also known as HEVC. Products are becoming available, but it is unlikely to be suitable for broadcast use for a couple of years, and is incompatible with current TVs. The ATSC is considering what would comprise ATSC 3.0, and commenting that it is not likely to be compatible with the current ATSC receivers. If Spectrum repacking can await these developments, then the most spectrum can be made available for other uses.
37) Charles W. Rhodes and Doug Lung have been examining the issues of broadcast TV channel interference and tuner performance. The FCC has TV tuner performance as a possible rule-making item. The effectiveness of repacking depends on these items being resolved. One complication to understand is that non-linearity causes intermodulation. The non-linearity can

be something as common as some corrosion, tarnish or rust in a connection between two pieces of metal. While gold does not have that problem, it is expensive. The intermodulation is interaction between two or more signals to produce two or more other signals. There are plenty of signals around. To understand this in practice would best be illustrated by a movie of this on a spectrum analyzer. In the real world, this introduces a lot of variability and unpredictability so that what seems conceptually straightforward is liable to have unexpected problems and that there is no free lunch is a simple understanding relevant. Another complication is that improved selectivity of filters can assist, but these cost more and also more selective filters have more group delay variation which can be a problem for digital signals. Wikipedia has entries on these terms and also the "rusty bolt effect". However I have not found an adequate video illustrating this. An introduction can be found at http://www.anritsu.com/en-GB/Media-Room/Newsletters/files/guidetospectrumanalyzers.pdf.

38) The HD Radio definition needs development by experts in this matter. This is the most urgent item on the critical path.
39) The seismic risk to Los Angeles is known to be serious. In addition there are unknown seismic risks. The lesson of L'Aquila is relevant to this work.
40) Although Federal legislation has been proposed, funding is a relevant issue. An earthquake Alert system would require both FEMA funding for alerting and USGS funding for the seismology development. Just providing one would not be adequate.
41) Much of the above is focused on broadcasting. Cable, DBS, Sirius/XM and Telco TV providers also have issues. One is the conflict between broadcast and other delivery of EAS alerts.
42) Cyberwar is a serious issue, and there are threats and opportunities to address in this area for EAS.
43) The non-broadcast participants involved with EAS redefinition include Motorola, Cisco, SCTE (Society of Cable Television Engineers), Verizon, AT&T, DirecTV, Dish Network (Echostar), Sky Angel, SiriusXM and some others. This is not a large list, but EU and some other participants may also be appropriate. The ITU should be involved at a later phase, which is a reason to involve other countries beforehand.
44) A Quality Control system should not be a trigger for FCC inspections within a time period of reporting an issue. A 30 day period is proposed. Any FCC inspections scheduled to a broadcaster that had an issue flagged in the QC process should have the inspection postponed until after the 30 day period. It is not expected that one government department would refuse to make such information to another government department, from a broadcaster perspective. The QC system should be automated and under the State Emergency Management Office responsibility.
45) The State Plan for such a new system should be developed as a generic version applicable to all states first. The detailed data in such a plan should be automatically extracted from the FCC database where possible on initial Plan development and on any updates to the FCC database. Then such changes shall be brought to the attention of an administrator for checking, especially where items relating to Digital Daisy Mesh monitoring assignments are changes. Otherwise plans become inaccurate. This would take software development.

46) The development of an improved EAS has various activities and components. The relationship between them can be considered in terms of the following diagram. Currently EAS as existing and CAP are defined and the ECIG has developed a definition of how to relate the two.

A Conceptual Map of the Components of EAS+



The four items "here" are draft components for a standard to be developed, perhaps with OASIS, and MAY be named "EASplus Standard".

The Roman numerals refer to the section of such a document. ECIG developed the section IV and it is proposed for this to be part of the standard, primarily for the transition compatibility.

47) EAS should be capable of delivering earthquake alerts to cell towers.

WEA Strategy

48) This is beyond the scope of this paper other than to comment that Earthquake Alerting would require development involving CalEMA, FEMA, the FCC and Telecom vendors.
49) Cyberwar is a threat.

MEAS Strategy

50) This is a variation of TV broadcasting, and much of the TV improvements can be directly applied or adopted.
51) With WEA, MEAS and Broadband EAS, it would be possible for smartphones and tablets to receive alerts from all sources. While WEA has no message ID, the other two would carry a message ID so it should be possible to omit the last duplicate message or using it to correct any received errors.

Broadband EAS Strategy

52) This is likely to be direct transmission of CAP and some EDXL messages. How these are handled may require not just an added application, but perhaps some capability added to the operating system e.g. to provide a crawl or text line similar to TV.
53) Cyberwar is a threat and an opportunity to address.

ETN, Emergency Telephone Notification (formerly R-911)

54) This is included for completeness. It uses the Telco address database for alerting and the capabilities are dependent on the software developed and processing provided.
55) Sometimes this system is used by local governments to distribute alerts that are not currently delivered by EAS at present such as water quality advisories and promotions of events and election related items. An EAS event code for some such messages is desirable with the proviso that such messages are not carried at all by broadcasting.
56) School weather closings are a sort of emergency message. These could be provided for in EAS as the ability to avoid them and continue with normal programming may be desired by some listeners.

Alerting Service Vendors

57) There may be some additional capabilities to provide to alerting service vendors. The most important issue appears to be to resolve any compatibility issues with ISO 22301 and similar standards. Then the developers of BC/DR software can allow for alerting input e.g. to automatically trigger file saves when an alert is received.
58) Antivirus and other types of computer security vendors are also relevant because of cyberwar issues.

GAO 13-375 Emergency Alerting Capabilities Report Comments

Please read the GAO report before considering these comments.

A) The diagram of the Daisy Chain on p.5 depicts radio stations relaying to TV stations but not vice versa. While there may not be any implementation of the latter, there is no technical reason for that, only an equipment pricing difference. However, now that TV is digital, the higher quality of the audio would make TV a desirable distribution source. Also, as is commented elsewhere, the higher data rate available makes TV a more desirable data source. Since TV broadcast coverage areas are normally larger than FM, and may be extended further with translators, repeaters or fiber to cable/Telco headends, this make TV advantageous for EAS message distribution. That is, with selectivity provided for.

B) The SCTE J-STD-042-2002 is a standard that could be utilized to have selective STB override of cable channels by EAS messages. While the standard might not make the mechanism apparent, I asked an SCTE engineers some questions to clarity the standard and have the answers noted.

C) However this does not provide a selectivity mechanism for broadcasting. This is my contribution for TV audio and video. While a mechanism does appear possible for HD Radio, I would rather that David Maxson or someone comparable develop a suitable definition of a mechanism to replace my suggestion.

D) There is no reference to Dr. Rita Kepners' thesis on "The Efficiency of the Emergency Alert System" although the data and conclusions there are quite pertinent to the GAO report.

E) There is no mention of CMAS being renamed WEA (Wireless Emergency Alerts) by the FCC, however this is likely a timing overlap matter.

F) On pages 9 to 15 is a section on barriers remaining to more effective implementation. As I pointed out at the EAS Summit in 2008, there is a problem with the current value paradigm. Basically EAS is currently a wide area alerting system that interrupts regular programming. As such it is for infrequent but highly valuable use. The infrequent use reduces the value, and makes for financial and political problems. The infrequent use is necessitated by i) The lack of a mechanism to enable more harmonious inclusion as part of program content, which annoys many people. ii) The lack of a selectivity mechanism to enable messages to be delivered to less than a broadcast coverage area e.g. a county or county sector or a polygon. Iii) The lack of a selectivity mechanism to enable messages when they are not intended for the general public listening e.g. when the alert is for a distant broadcaster and the LP broadcaster is obligated to transmit the alert, or

when the alert is to a selected category of recipients such as first responders as may like to use EAS as part of an exercise to become more familiar with it and other IPAWS systems. This is also an aspect of Dr. Kepners' thesis. The thesis considers what macroeconomic considerations could be applied to make some improvements. However the improved and improving economics of electronics is enabling a solution approach which basically uses more transistors and software. Iv) The lack of a financial encouragement for broadcasters to be more pro-active in supporting EAS as distinct from avoiding penalties for non-compliance. EAS consumes air time and valuable station staff time (primarily engineers), who are on the expense side of the financial considerations. If improved technology were able to be applied to reduce costs or improve income, then this ought to be considered even though the original application was only for public alerting (which is a public service as PSAs, Public Service Announcements, are). This would be a way of Emergency Management appreciating the owners of the valuable infrastructure that they are borrowing.

G) Dale Gehman made an FCC filing pointing out problems arising from the current wide area coverage of EAS messages. A copy of his filing is available at www.pattcom.com/eas.

H) Also in terms of the value of public alerting, there was a graph on a FEMA web page once that showed a relationship between severity and frequency of disasters. The graph had no values attached. However the shape of the graph resembled a curve that electronics engineers are acquainted with as the $1/f$ noise curve. So using that as a first approximation, different alerting technologies can be compared. A market survey would provide some data, but such a survey was not undertaken by anyone as far as I have ascertained. So my observations are not precise, but have been published elsewhere and better data would be of assistance. Nonetheless, EAS is currently unsuitable for the smaller, more localized, and more frequent emergencies messages. If the selectivity technology mentioned previously could be implemented, this would lead to more frequent use with less of the negative value of the annoyance/inconvenience of those for whom the message is not targeted. This would add to the value of EAS as part of a better value paradigm. Then finance should be less of a problem.

I) On p.15 to 21 is a section on the implementation of IPAWS. One problem noted is the ability to test IPAWS components by the state and local governments. For example, a city may have an ETN system but only be able to test that and nothing else without sending live alerts which are not avoidable with WEA and also not currently avoidable with EAS. The improvements I have proposed however address the latter. Perhaps as Broadband for Emergency Management becomes more widely deployed, then WEA messages to such cellphones would become a consideration as a selected receiver type.

How to implement that should be part of developing a WEA standard for test transmissions.

J) When the GAO released their report in 2009, I submitted comments to that office in response. However there does not appear to have been any consideration of any of those comments in this latest report. While the GAO has a legal obligation to oversee Federal expenditure utilization, and hence the State and Local Governments who are receiving Federal funding, the IPAWS is also involving Cellphone vendors, Broadcasters, Telcos, the public and equipment vendors for everyone. The public and their equipment are not a GAO responsibility, nor FEMAs, and the FCC oversight of that aspect would best be maintained as it is at present. However all of these entities are stakeholders, and good Project Management would be considering all of them and their unique situations and needs. Consumer Electronics is receptive to well-engineered, standards-based solutions that mesh with the worldwide economic nature of that business. For one example, the Future of Broadcast TV (FoBTV) meeting in Shanghai adopted a goal of merging all the worlds TV systems. This would mean that only one TV design would work anywhere in the future. It would therefore be counterproductive to attempt to mandate anything that would be unique to the U.S. On the other hand however, CAP is being adopted as an ITU and therefore world standard. Similarly, the Next-Generation EAS should be considered with a goal of becoming a complementary system to CAP as an ITU standard. Would consumer electronics adopt such a standard? Well, the best evidence of that is a JVC HD Radio/navigation car receiver that has incorporated CAP capability. Such a receiver is basically a PC running Windows CE or Linux or QNX. While this is one possible strategy, it does not provide a solution for myriad TVs and radios which may only have an 8 bit microcontroller if anything. A Next-Generation EAS should be able to utilize 8 bit microcontrollers and also still work on receivers without microcontrollers. The added cost for an optional feature should be in the order of 2c per unit. CAP is unable to do this, it needs a PC. PCs cost more, use more power and also generate Electromagnetic Interference (EMI) which makes it more difficult to receive the radio or TV signal.

K) An assumption with EAS is that, unlike normal computer usage, EAS equipment is expected to operate for long times without crashing (preferably many years), and to be error free whenever operating. While periodic tests provide a level of functioning testing, they do not exercise all the code. It would be possible for one bit to be incorrect for many years and for this to not be noticed until such a situation occurs that depends on that bit. Now we are putting at risk peoples' lives or severe consequences depending on the value of one bit. The probability of every bit being correct is quite high, but it is not exactly 1, i.e. the probability of an error is not exactly 0. Based on experience in a facility which originated about 20 TV channels, I know that bits can flip on their own, for

no apparent reason. These are soft errors. They may be caused by SEUs (Single Event Upsets). Cosmic rays and background radiation is one cause of these. PCs of the type used for EAS are unsuitable for use in space because of the higher radiation levels. I discussed this with KK Ma of Sandia National Laboratories and we came to two conclusions. A) The types of computer that are used in space, using radiation hardened chips, triple CPUs, etc. are very expensive and not being PCs, cannot run any existing EAS software. B) That a feasible solution to this problem, sometimes used in space and military systems, is to use scrubbing software. When the code is constant, and the data is mostly constant (except for new messages and log files mostly), scrubbing software can be developed so that in the background, every piece of code and data (except for the above and the data that the scrubbing software is working on) can be checked between at least 3 sources. This not only enables errors to be detected but also corrected, either automatically or with operator approval. All errors found and corrections made can be added to the log file. While no current EAS vendor provides this, we are developing specifications for a system that is likely to be used for perhaps 20 years or more. This is a significant amount of risk exposure for this country for it to be worth developing a better solution than what is currently implemented. The frequent crashes of normal computers have made people inured to such problems, however I am not about to suggest that this be acceptable for a system where large numbers of lives are at stake. I know computers can be reliable because I have worked with a PC that apparently never crashed in the few years before I started work there and never crashed in the five years I was there.

L) Insufficient Public Outreach is mentioned. This is in line with the stakeholder involvement previously mentioned, but also could be in the form of a market survey. This would take thought and an effort to be well defined, and a budget. New technological capabilities should be included. An example topic might be to provide alternative user controls over alerts received e.g. 1 being avoidable for some message types during sleeping hours and 2 to 10 being a scale with 10 representing everything including school weather closings which are not currently part of EAS. You know, it spoils the morning drive when all you seem to be able to receive is school weather closings that do not relate to you. It also costs the broadcaster their audience size.

M) The Consumer Electronics Association was not apparently consulted. They may be considered the elephant in the room as almost all alerts are dependent on consumer electronics (CE). While the Federal Government has influence over state and local governments, any attempt to mandate in the CE area is likely to be met with serious lobbying if CE interests are not appropriately incorporated. This means appreciating the market sensitivity to the price and desirability of features.

N) While parts of the disabilities question are dependent on the receiver capabilities, text for display and speech audio are important. This gets more complex when multilingual capabilities are required. For example, in New Orleans, there was no Latino radio station operating, and alerts were only in English elsewhere. A Next-Generation EAS should provide this and I made a proposal in 2009 to the FCC as to a means to do so. This FCC filing was brought to the GAO attention, but does not seem to have been considered in this report.

O) The Nationwide Test is described as to the results, but an important detail lacking is whether the audio was carried digitally (which maintains the quality of audio and signal level) or analog (which degrades the audio and the signal level can vary). A problem with the Daisy Chain is that it is currently radio-centric and not TV-centric. TV only has digital audio, but radio audio may be analog or HD Radio. However the current EAS monitoring receivers do not currently provide for HD Radio which is digital and fixed level with a digital audio output.

P) The Federal responsibility of the GAO does not obligate it to consider how local and state governments can utilize their resources more efficiently by replacing limited first responders available in emergencies with improved public alerting technology. For example, NOAA produces SLOSH maps for hurricane surge height and with topographical maps can develop inundation maps. Some Emergency Managers are developing flood area maps. However at preset neither can be broadcast to the public, e.g. to HD Radio/Navigation receivers which might only need a software upgrade. FEMA has not responded to a letter on this from a New Jersey Senator. Also other states would not doubt welcome such a capability. California and perhaps other states would like to have an Earthquake Early Warning System which includes EAS and WEA. The present EAS is not suitable for such rapid alerting. For a start, it is subject to the latency of compression systems at present for digital systems. Selectivity is another aspect as earthquakes are rarely statewide. Terrorism response is another issue, but the GAO did not mention the local aspect which is a selectivity matter again. By local, this also includes regional and Tribal government. The Presidential Alert is appropriately emphasized, but the local end of the spectrum has room for improvement. So while improvements are proposed or recommended, the nature of the whole problem is larger than the scope that appears to be considered. The problem with such a limitation is that there is a risk that the solutions obtained may be suboptimal, or not the best that can be attained when a larger territory is considered. This could be compared to going uphill to find the top of the tallest mountain, when the actual tallest may be on the other side of the Mississippi river.

Q) There is no mention of cyberwar aspects. There needs to be security of the system that is of a high level, unlike the ability to successfully hack in as occurred recently with the

zombie alert. Also, as there is the possibility to broadcast data, which could be applied to cyberwar defense. This would be a way to bypass the internet when the internet may not be effective because of some cyberwar attack.

R) The coverage varied considerably from state to state, and the sampled states went into this is more depth. While the Federal Government has influence over state and local governments through legislation and funding, the question of the value of EAS to state and local governments does not appear to be highlighted. This is the value paradigm subject. If there were no Federal influence other than coordinating and consulting, would EAS be an attractive product? Probably not. So the importance of selectivity and a Digital Daisy Mesh other capabilities to make it valuable for local use serve to make it more desirable and improve the coverage. By so doing, this should make the use of Federal finance to State and Local Governments more efficient. While that might not be as obvious on a balance sheet, I expect that wise financial people appreciate what I am pointing out here. It would be helpful if the selectivity mechanism could alternatively be used for alternate advertising content. This would be subject to approval e.g. by the State Plan. This needs to be discussed with FEMA, the FCC and Emergency Managers.

S) The funding of improved technology can be significant, and the general taxpayer as a source has limitations. The Japanese reportedly paid $500M for their nationwide earthquake warning system. It is dubious as to whether this level of funding would be contemplated in this country. However as earthquakes are quite expensive, a public alerting system for mitigation should be able to save insurance companies a sizeable amount in medical and life insurance payouts. Whether the GAO has the capability to share the savings with the insurance industry as a source of funding is unknown, it is probably not part of how FEMA is legislated. Perhaps this can be addressed in future IPAWS legislation.

T) The only DBS vendor mentioned was DirecTV. Echostar/Dish Network and Sky Angel were not. The only alerting on DBS currently is the Presidential Message. While that is important, the infrequency makes this of low annual value. With an improved definition of EAS, it should be possible to implement a selective alerting technology based on e.g. a data stream of 38.4k Baud and 2 voice channels. The second would be Spanish or French depending on the region being alerted as Canada also receives DBS. There needs to be a prioritization scheme as a two nation (Mexico also someday?) system may have too much traffic at times so lower priority messages may be delayed and even time out. Because of the delay, earthquake alerts should not be expected to be delivered by satellite. The selection of the alerting would be in the STB (Set Top Box). STBs are normally at a fixed location, which the STB would have to have entered and stored by some means. RV type DBS receivers are mobile, so discussing this with such vendors would be appropriate. SiriusXM currently provides an alerting channel, but has no data

stream or selectivity mechanism, which would require being able to receive location from a GPS receiver in a standard protocol such as NMEA 0183 with digital degrees possible to 5 place resolution.

U) The value of engineering standards is not apparent in the report. IPAWS is based on the CAP standard which was initiated by Art Botterel and developed through OASIS. This is accompanied by a group of EDXL standards for emergency management uses. These are all in process toward becoming ITU standards. Putting a Next-Generation EAS through the same process would add value because it would then be valuable for consumer electronics. ,As the adoption of this feature is not guaranteed, I have offered CEA that this feature could be included in radios and TVs without royalties, though model group compatibility testing should be required before the feature can be advertised.

V) The future of IPAWS is probably the expanded use of CAP, even broadcast to smartphones and other suitable devices with Forward Error Correction. MEAS is not mentioned, but is relevant. Also Broadband EAS is a developing technology that is not mentioned. As the transistor count on earth has exceeded the number of ants by about a hundred fold, and continues to increase, the future needs to be considered.

In conclusion, there has been worthwhile progress since the 2009 GAO report, as the author is the same and is familiar with the subject. On the other hand, important aspects continue to be omitted, which may reflect to scope the author was given or has for a job description rather than any other reason for oversight. This report is a quite important contribution to the dialog on this important subject, and it is encouraging that the Representatives of the House who requested it are taking an interest in this important subject. One example of this is that the initial estimate of casualties of the tornado in Moore was over 100, probably based on the amount of damage. That the final toll was 24 was tragic, but much less so because in the past year WEA has deployed and there were numerous reports of people being alerted by this means and avoiding being in harms' way. Another example is to compare the eruption and tsunami in Samoa several years ago. American Samoa had an EAS alert, but Western Samoa (a New Zealand protectorate) did not and the difference in fatalities was quite significant. There were 149 in Samoa, 31 in American Samoa and 9 in Tonga.